Abstract

Executive Summary

Overall, we have learned that homeschooling is on the rise globally, especially after the COVID pandemic. Parents choosing to homeschool their children, and educators at large, view emergent technologies as powerful tools and generally express a desire and willingness to incorporate AI-powered systems into their teaching.

Of the educational software on the market and in development, promising new products are built upon the GPT-4 foundation model. Students and educators are able to interact with these systems via natural language, making them generally accessible. The most valuable aspect of most AI-based tools for education is their ability to provide personalized learning for educators and students from various backgrounds and needs.

In the context of homeschooling, parents become the educators and are often responsible for the education of multiple children who are in different grades and likely have various learning styles. Through our research, we noticed that many AI tools, like Khanmigo, are being developed to help educators in curriculum development. However, Khanmigo's demo is focused on lesson planning for a class. While a homeschool educator could benefit from these ideas, having a system with the ability to give suggestions specific to the individual nature of the homeschool setting could provide even more of a benefit.

Literature Review

In order to better understand the various areas of interest of the team, we conducted a literature review and looked for scholarly articles surrounding the topics of individualized education, homeschooling especially in regards to curriculum design and teaching resources, and AI applications within education. Below we have included seven sources with a short summary capturing the essence of each study.

1. A. A. Aburas and R. Shreef, "On-line homeschooling learning management system using intelligent tutoring system," *2010 International Symposium on Information Technology*, Kuala Lumpur, Malaysia, 2010, pp. 967-971, doi: 10.1109/ITSIM.2010.5561579.

   Homeschooling is an effective method of overcoming the constraints of traditional education systems in rural and distant areas. It is a new, cost-effective type of education, especially for developing countries. This study introduces a new management system for evaluating homeschooling exams, resulting in better results and student feedback.

Exploring the prospects of integrating Intelligent Tutoring Systems (ITS) into Libyan homeschooling programs is the aim of the study.

2. Browne, Joanne. *Parents' Rationale for Homeschooling : A Qualitative Study*. Youngstown State University, 1997, https://digital.maag.ysu.edu/xmlui/handle/1989/6336.

   This qualitative study focused on parents' reasons for homeschooling, uncovering that family togetherness and religious/parental rights were frequent responses. The methodology used was a one-page, self-administered survey distributed through email, support group meetings and a mailed newsletter. Results highlighted the commitment of homeschooling parents to their children's education and showed that computer technology was a useful tool for data collection, providing world-wide participation with minimal expense.

3. K. Premendran *et al*., "Assistant Zone – Homeschooling Assistance System based on Natural Language Processing," *2022 4th International Conference on Advancements in Computing (ICAC)*, Colombo, Sri Lanka, 2022, pp. 13-17, doi: 10.1109/ICAC57685.2022.10025201.

   In the face of the pandemic, the "Home Schooling Assistance System" (Assistant Zone) has been introduced as a solution to improve education in developing countries. It features three unique features - analyzing strengths and weaknesses, suggesting study materials to improve, and providing solutions to problems faced by students, teachers, and parents - through Natural Language Processing (NLP) and Machine Learning models.

4. Toquero, C. M. ., and C. . Tusoy. "Contextualized Education in Remote Areas During Pandemic through Parent-Support Homeschool Learning". *Jozac Academic Voice*, vol. 3, Mar. 2023, pp. 6-9, https://journals.jozacpublishers.com/jav/article/view/371.

   Children of ethnic origin located in marginalized areas are susceptible to educational inequalities due to the lack of internet connection and socio-educational support. Through a Home-Based Education Program, this article presents the process of the development of an emergency homeschool learning in remote areas in a province in the Philippines. Implications to homeschool curriculum include the provision of contextualized emergency remote materials for ECE homeschool learners and

instructional session guides for the parents to support home-based experiential instruction for their children.

5. Cook, K. B., K. E. Bennett, J. D. Lane, and T. K. Mataras. "Beyond the Brick Walls: Homeschooling Students With Special Needs". *Research, Advocacy, and Practice for Complex and Chronic Conditions*, vol. 32, no. 2, Nov. 2013, pp. 98-111, doi:10.14434/pders.v32i2.12997.

   In 2002, the top diagnoses of homeschooled students were attention deficit hyperactivity disorder (ADHD), learning disabilities, autism spectrum disorder, and speech impairment. It is often dissatisfaction in how the public school system supports students with special needs that drives parents of these children to homeschool. Some reported challenges include "a lack of emotional, social, and moral support from outside sources." Such support was more easily found in other homeschooling families and in organized homeschool groups rather than in public schools.

6. Seo, K., Tang, J., Roll, I. *et al.* The impact of artificial intelligence on learner–instructor interaction in online learning. *Int J Educ Technol High Educ* 18, 54 (2021). https://doi.org/10.1186/s41239-021-00292-9

   This study was conducted to better understand both the student and instructor perception of artificial intelligence's impact on the learner-instructor connection through use of storyboards that can help facilitate further research on AI's impact on online learning. Findings of the study showed that both students and teachers were hopeful due to the increased personalization afforded.

7. Pelaez, Alexander et al. "The Turing Teacher: Identifying core attributes for AI learning in K-12." *Frontiers in artificial intelligence* vol. 5 1031450. 14 Dec. 2022, doi:10.3389/frai.2022.1031450

   The Turing Teacher refers to an AI-powered teaching agent that is able to be used such that the student is unable to distinguish between it and a human teacher based on the understanding that the perception of the interaction with "teachers" (whether human or AI-powered) impacts learning outcomes for students. This study concluded that in order to be effective, the Turing Teacher must do the following: address attributes of various stakeholders (students and parents), enable oversight from a human whether that be a

parent or an official educator, facilitate meaningful group interactions for students, and aid students in adapting to their environments.

Comparative Review

We explored different systems currently available that use software to enhance and individualize the learning experience. Some of the most promising applications are built upon the GPT-4 foundation model, allowing for content personalization. However, no homeschool-specific AI options were found. The products and our analysis is as follows:

1. Duolingo Max: a platform for language learning built off of GPT-4.
   - Pros
     - "Explain My Answer" feature which allows for better understanding by explaining why a given answer is correct or incorrect.
     - Roleplay feature allows for simulation of a conversation which is a critical aspect of improving language skills.
     - The system is individualized.
   - Cons
     - Duolingo Max is a system to practice language skills rather than a source of instruction. It seems like it would need to be used in addition to another form of instruction.
     - Only available in limited countries at launch, though they are working to expand.
     - Only available for English speakers learning Spanish or French on iOS at launch, though they are working to expand.
2. Khanmigo: a platform for student tutoring and educator assistance built off of GPT-4.
   - Pros
     - For students:
       1. A chatbot tutor can assist students in learning without directly giving them the answers.
       2. The system can act as a writing coach, giving prompts and suggestions.
       3. Khanmigo can understand code and help students learn computer science.
     - For educators:
       1. The system can help with AI-guided lesson planning to fit with what students have already learned.
     - Approximately 1,000 teachers, students, and school district administrators were invited to test the program for free.
   - Cons
     - The system is not yet publicly available. To get access to the system, one must donate at least $20 monthly.
     - It seems the system for educators is geared toward teachers with a classroom of students. It might not be as helpful for a homeschooling parent with one or a few children to teach. It would probably not take

advantage of the opportunity for individualized learning available in the homeschool setting.
3. PowerSchool: an educational logistics and operations software system.
    ○ Pros
        ■ It is very user-friendly and allows for simplification of administrative tasks, such as grade entry or paperwork management, to be simplified and centralized.
        ■ It is very accessible with lots of languages available for translation purposes as well as integration with accessibility tools, making it available for many people to use.
    ○ Cons
        ■ The system is not easily customizable which robs users of a certain level of autonomy. Customization is available, but it is quite expensive.
        ■ There is a seeming lack of sufficient onboarding and step-by-step instructions provided for users which can make the learning process unenjoyable for new users.
4. Ghotit: an application to help with reading and writing for those struggling with dyslexia and/or dysgraphia.
    ○ Pros
        ■ Inline word predicting feature: considers grammar, punctuation, context, and use of phonics. Suggestions can be read aloud and defined.
        ■ Spell check.
        ■ Check for grammatically incorrect words or out of context words.
        ■ Notes repetitions and gives suggested alternatives.
        ■ Text to speech.
        ■ Word-by-word highlighting for reading and understanding.
    ○ Cons
        ■ Universal software license is $249 annually (software for 2 computers and editor apps for 2 iOS devices). Individual elements can be purchased separately at lower costs.
        ■ Most of the functionality is already available for free in word processing applications like Google Docs and content checkers like Grammarly.
5. Snap&Read: an application with a toolkit to support reading comprehension.
    ○ Pros
        ■ The tool is designed with features to support students who are neurodivergent and have difficulty with learning to read which allows for personalized lessons and aids.
        ■ Relatively affordable at $75 per year for one account.
        ■ The tool is relatively simple, making it very easy to use and onboard new users.
    ○ Cons
        ■ This tool is not accessible for students who are blind and thus marginalizes that community.

Expert Interview Plan

For our project, we want to talk to multiple stakeholders and individuals with a variety of backgrounds to better understand the problem space. To that end we want to interview parents with homeschooling experience, individuals who were homeschooled in the past, and academic experts passionate about non-traditional schooling and the use of technology in education.

For our first expert interview, we plan to interview Kristy Newport. Mrs. Newport is a mother of four and has experience homeschooling three of her children at various ages, one of whom has ADHD. She is a Licensed Marriage Family Therapist (LMFT) and is currently pursuing her doctorate in a leadership program.

Mrs. Newport has agreed to be interviewed, and scheduling for sometime this week is in process.